REMARKS

Claims 1, 11, and 20 have been amended.

No claims have been cancelled.

Claims 1-29 are currently pending in this application.

Claims 1 and 20 are in independent format.

1. Rejections Under 35 U.S.C. § 103(a)

a. Claims 1-8, 20-26, 28, and 29

The Examiner's rejection of Claims 1-8, 20-26, 28, and 29 under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 5,018,393 to *Seegers* in view of Applicant's admitted prior art U.S. Patent No. 5,708,216 to *Garshelis* is respectfully traversed. The Examiner's stated basis for the rejection is that the '393 *Seegers* reference discloses all of the claimed features of the invention but for a magnetoelastic ring press fit to a bearing inner race. The Examiner contends that the '216 *Garshelis* reference teaches a magnetoelastic ring press fit to a shaft, and that therefore it would have been obvious to modify the teachings of the '393 *Seegers* reference according to the teachings of the '216 *Garshelis* reference for purposes of providing an magnetoelastic torque transducer having a single output signal including shaft torque and speed information, enable power to be determined from the transducer.

Contrary to the Examiner's stated basis, the '393 *Seegers* reference does not disclose all of the claimed features of the invention. Rather, the '393 reference teaches a shaft torque sensor system which operates in an entirely different manner from the present invention as set forth in amended independent Claims 1 and 20. Specifically, the '393 reference requires a pair of annular pick-ups or rings which are spaced apart

along a length of the shaft to be observed. Preferably, as shown in Figs. 1 and 2, the annular pick-ups or rings are disposed on opposite ends of a bearing supporting the shaft, so as to provide an axial distance there between.The rings pick-ups or rings are *not* disposed on the bearing inner race. Sensors associated with each of the annular pick-ups or rings observe magnetic pulses form the pair of pick-ups or rings as the shaft rotates. When a torque is applied to the shaft, and acts over the axial distance separating the two pick-ups or rings, an angular deviation is induced between the observed magnetic pulses at each sensor. Hence, the '393 *Seegers* reference requires a pair of sensors which are displaced axially along a shaft in order to observe torque-induced angular deviation in rotating magnetic pulses at two discrete locations along the shaft. The '393 *Seegers* reference cannot function with only a single sensor, and does not measure or observe changes in electrical conductivity and magnetic permeability or a magnetoelastic ring press fit to a bearing inner race as required by amended independent Claims 1 and 20.

Further, understanding that the '393 Seegers reference requires a pair of pick-ups or rings displaced axially along a rotating shaft to observe torque-induced angular deviation in rotating magnetic pulses, one of ordinary skill in the art would not combine the teachings of the '216 *Garshelis* reference. The '216 *Garshelis* reference directly measures torque and rotational speed of a shaft at a *single location* characterized by a magnetoelastically active element *which is disposed directly on the shaft surface* and which is not associated with any bearing structure. The '216 reference does not produce an output which may be used to identify torque-induced angular deviations over an axial length of the shaft. Furthermore, the '216 reference does not suggest the coupling of

any torque sensing elements to the inner race components of a shaft supporting bearing. Hence, the combined teachings of the '393 reference with the '216 reference would merely produce a device which obtains *two* separate torque measurements from points which are separated by *an axial distance* on opposite sides of a bearing structure, but which are not representative of shaft torque *at the bearing inner race*. Hence, as amended, independent Claims 1 and 20 are seen as non-obvious and patentable over U.S. Patent No. 5,018,393 to *Seegers* in view of U.S. Patent No. 5,708,216 to *Garshelis*.

Dependent Claims 2-8, 21-26, 28, and 29 each depend either directly or indirectly from amended independent Claims 1 or 20, and are correspondingly seen as non-obvious and patentable over U.S. Patent No. 5,018,393 to *Seegers* in view of U.S. Patent No. 5,708,216 to *Garshelis* for at least the same reasons as their respective parent claims, and for any additional reasons set forth below.

With respect to Claims 2, 3, 21, and 22 the combined teachings of the '393 reference with the '216 reference fail to render obvious the inclusion of any magnetoelastic components on a bearing inner race element, but rather, suggest at best, to couple such components directly the rotating shaft *on opposite sides of a bearing*. The Examiner's reference to Figure 2 of the '393 reference, and specifically to the Examiner's statement "ring 15 is press fit to the inner race upon a journal 16" does not support the Examiner's position, as "carrier ring 15" and "outward angled bore regions 16" are not fitted to the bearing inner race, but rather, are disposed on the surface of the rotating shaft *on opposite sides of the bearing rolling elements*.

With respect to Claim 29, the Examiner's rejections appear to be in error, as the Examiner's arguments are directed towards limitations found in Claim 18, not Claim 29. Accordingly, clarification of the rejection of dependent Claim 29 is respectfully requested.

b. Claims 9-16, 19, and 27

The Examiner's rejection of Claims 9-16, 19, and 27 under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 5,018,393 to *Seegers* in view of Applicant's admitted prior art U.S. Patent No. 5,708,216 to *Garshelis* as applied to Claims 1-8, 20-26, 28, and 29 above, and further in view of U.S. Patent No. 2,438,288 to *Jacobson* is respectfully traversed.

Applicant respectfully notes that a complete copy of the '288 Jacobson reference does not appear to be available from the USPTO. The image files available for download from the USPTO are missing the drawing figures (if any) and at least the page containing Cols. 3 and 4.

The Examiner first contends that, with respect to Claims 9, 10, 12, 13, 19, and 27, the '393 *Seegers* reference discloses the use of a second excitation coil (13) and a second sensing coil (14) having equal amplitude and opposite phase, and hence, it would have been obvious to provide additional coils to determine the torque transmitted in a shaft, as duplicating components of a prior art device is a design consideration within the skill of the art, citing In re Harza, 274 F.2d 669, 124 USPQ 378 (CCPA 1960).

As set forth above, it has been shown that the combination of the '393 *Seegers* reference with the '216 *Garshelis* reference fails to render obvious the claimed invention as applied to Claims 1-8, 20-26, 28, and 29. Turning specifically to the '393 *Seegers*

reference as addressed by the Examiner, it is seen that the reference fails to show the use of a second excitation coil and sensing coil having equal amplitude and opposite phase. Reference numerals (13) and (14) in the '393 *Seegers* reference illustrate a pair of concentric magnetic rings held within a carrier ring. A hall effect sensor (10) disposed between the pair of rings acquires signals there from. (Col. 3, lines 9-14). Admittedly, the '393 *Seeger* reference discloses the use of two hall effect sensors (10) on opposite sides of the bearing, but as discussed above, these sensors are designed to operate cooperatively to provide a signal representative of angular deviation responsive to applied shaft torque *over the axial separation distance* there between. There is no disclosure in the '393 *Seeger* reference of any excitation or sensing coils having equal amplitude and opposite phase. Rather, to function properly and provide an accurate representation of torque-induced angular deviation, it would appear that the sensors of the '393 *Seeger* reference would need to be identical.

The Examiner's addition of the teachings of the '288 *Jacobson* reference with the '393 and '216 reference further fails to render obvious the claimed invention as found in Claims 9, 10, 12, 13, 19, and 27, as the '288 *Jacobson* reference is not directed to torque sensing systems, and has no disclosure of sensors associated therewith.

Rather, the '288 *Jacobson* reference appears to be directed exclusively towards an apparatus for filtering the effect of parasitic AC voltages at "commercial" frequencies from a measurement circuit using a wheatstone bridge configuration. (Col. 2, lines 1-7). The system of the '288 *Jacobson* reference is further configured to amplify any unbalanced AC potentials within a Wheatstone bridge network for purposes of detection and the operation of a "rebalancing motor" for use in a "motor-actuated se-balancing

apparatus" driven by a two-phase motor. (Col. 9, lines 52-55). In short, the '288 *Jacobson* reference appears to have nothing in common with the instant application other than the inclusion of similar basic electronic components. As such, one of ordinary skill in the art would have no motivation at all to combine the motor-drive and feedback circuits of the '288 *Jacobson* reference with the combined teachings of the '393 *Seegers* and '216 *Garshelis* references which are directed to applications for sensing torque on a rotating shaft. Accordingly, dependent Claims 9, 10, 12, 13, 19, and 27 are seen as non-obvious under 35 U.S.C. § 103(a) for these reasons and for the same reasons as their respective parent claims.

With respect to Claim 11, the Examiner contends that the '393 *Seegers* and '216 *Garshelis* references disclose all of the claimed limitations except for the components of the electrical circuit, which are further shown in the '288 *Jacobson* reference. As amended, Claim 11 requires the sensor output from the electronic circuits to be representative of a torque applied through the shaft in proximity to said sensing coil and inner race. In contrast, the system of the '288 *Jacobson* reference is configured to amplify any unbalanced AC potentials within a Wheatstone bridge network for purposes of detection and the operation of a "rebalancing motor" for use in a "motor-actuated se-balancing apparatus" driven by a two-phase motor. (Col. 9, lines 52-55). One of ordinary skill in the art would have no motivation to combine the motor-drive and feedback circuits of the '288 *Jacobson* reference with the combined teachings of the '393 *Seegers* and '216 *Garshelis* references which are directed to applications for sensing torque on a rotating shaft. Furthermore, the combination fails to teach or render obvious limitations of the parent Claim 1, from which dependent Claim 11 is based. Hence, Claim 11 is

seen as non-obvious under 35 U.S.C. § 103(a) for these reasons and for the same reasons as the respective parent claims.

With respect to Claim 14, the Examiner notes that the '393 *Seegers* reference discloses a ring (15) which is divided into two parts to which the coils are attached. As discussed previously, the '393 *Seeger* reference discloses the use of two hall effect sensors (10) on opposite sides of a bearing, but as discussed above, these sensors are designed to operate cooperatively to provide a signal representative of angular deviation responsive to applied shaft torque *over the axial separation distance* there between. There is no disclosure in the '393 *Seeger* reference of first and second sensing coils rotated to + and – 45 degrees from a center axis so as to focus on lines of compression or tension respectively in first and second magnetoelastic rings, as required by Claim 14 (via dependency from Claim 13). Accordingly, Claim 14 is seen as non-obvious under 35 U.S.C. § 103(a) over the cited references for these reasons and for the same reasons as the respective parent claims from which it depends.

With respect to Claims 15 and 16, the cited combination of the '393, '216, and '288 references fails to teach or render obvious all of the limitations of the parent Claim 1, and intervening claims 11, 12, and 13 from which Claims 15 and 16 depend. Hence, Claims 15 and 16 are seen as non-obvious under 35 U.S.C. § 103(a) for at least the same reasons as the parent claim and each intervening claim.

c. Claims 17 and 18

The Examiner's rejection of Claims 17 and 18 under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 5,018,393 to *Seegers* in view of Applicant's admitted prior art U.S. Patent No. 5,708,216 to *Garshelis* and U.S. Patent No. 2,438,288 to

Jacobson, as applied to Claims 1-16 and 19-28 above, and further in view of U.S. Patent No. 5,052,232 to *Garshelis* is respectfully traversed.

The Examiner's stated basis for the rejection is that the '393, 216, and '288 references combine to disclose all of the limitations of the claimed invention but for a magnetoelastic ring having knurled grooves over the outer diameter at +and -45 degree angles relative to the axial centerline. The Examiner further contends that the '232 *Garshelis* reference discloses rings (6,8) having knurled grooves, and hence it would have been obvious to use the teachings of the '232 *Garshelis* reference to modify the combined teachings of the '393, 216, and '288 references.

With respect to Claims 17 and 18, the cited combination of the '393, '216, and '288 references fails to teach or render obvious all of the limitations of the parent Claim 1, and intervening claims 11, 12, and 13 from which Claims 17 and 18 depend, as set forth above. Furthermore, the '232 *Garshelis* reference does not, as contended by the Examiner, disclose the use of magnetoelastic rings *fitted to a bearing inner race,* having knurled grooves on an outer surface. Rather, the '232 *Garshelis* reference discloses to *directly alter* the surface of a rotating shaft itself, by providing knurled grooves in the shaft surfaces which provide magnetic anisotroipy stresses within the shaft surfaces. See: Col. 12, line 50 – Col. 13, line 38. Accordingly, Claims 17 and 18 are seen as non-obvious under 35 U.S.C. § 103(a) over the cited combination of references.

d. Claim 29

The Examiner's rejection of Claim 29 under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 5,018,393 to *Seegers* in view of Applicant's admitted

prior art U.S. Patent No. 5,708,216 to *Garshelis* as applied to Claims 1-8, 20-26, and 28 above, and further in view of U.S. Patent No. 5,052,232 to *Garshelis* is respectfully traversed.

The Examiner's stated basis for the rejection of Claim 29 does not appear to correspond to the limitation found in Claim 29. Rather, it appears that the Examiner's stated basis is directed towards the limitations found in either Claim 13 or 18. Accordingly, clarification of this rejection is respectfully requested.

Regardless, as discussed previously in connection with Claim 20, from which Claim 29 depends, the '393 Seegers reference requires a pair of pick-ups or rings displaced axially along a rotating shaft to observe torque-induced angular deviation in rotating magnetic pulses. The '216 *Garshelis* reference directly measures torque and rotational speed of a shaft at a *single location* characterized by a magnetoelastically active element *which is disposed directly on the shaft surface* and which is not associated with any bearing structure. Neither the '216, '393, or the '232 references suggest the coupling of any torque sensing elements to the inner race components of a shaft supporting bearing. Hence, dependent Claim 29 is seen as non-obvious and patentable over U.S. Patent No. 5,018,393 to *Seegers* in view of U.S. Patent No. 5,708,216 to *Garshelis,* and further in view of U.S. patent No. 5,052,232 to *Garshelis* for at least the same reasons as parent Claim 20 from which it depends.

2. Conclusion

Based on the foregoing, the allowance of claims is requested. If for any reason the Examiner is unable to allow the application on the next Office Action and feels that an interview would be helpful to resolve any remaining issues, the Examiner is

respectfully requested to contact the undersigned attorney for the purpose of arranging such an interview.

Respectfully submitted,

/Mark E. Books, Reg. No. 40918/
Mark E. Books, Reg. No. 40,918
Polster, Lieder, Woodruff & Lucchesi, L.C.
12412 Powerscourt Drive, Suite 200
St. Louis, Missouri 63131
Tel: (314) 238-2400
Fax: (314) 238-2401
mbooks@patpro.com